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Record of Decision:

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OAK RIDGE, TN
01/13/2000

DOE/OR/01-1734&D3

OU-22
Record of Decision
for the K-1070-a Burial Ground
East Tennessee Technology Park,
Oak Ridge, Tennessee

Jacobs EM Team

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

DOE/OR/01-1734&D3

Record of Decision
for the K-1070-A Burial Ground
East Tennessee Technology Park,
Oak Ridge, Tennessee

Date Issued – January 2000

Prepared by
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Oak Ridge, Tennessee
under subcontract to Bechtel Jacobs Company LLC

Prepared for the
U.S. Department of Energy
Office of Environmental Management

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
East Tennessee Technology Park
Oak Ridge Y-12 Plant Oak Ridge National Laboratory
Paducah Gaseous Diffusion Plant Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

PREFACE

This *Record of Decision for the K-1070-A Burial Ground, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-1734&D3) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This work was performed under Work Breakdown Structure 1.12.01.03.01.01.02. This document presents the formal decision of the U.S. Department of Energy, in conjunction with the U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation, to implement the selected remedy for the K-1070-A Burial Ground. This document summarizes information from the remedial investigation (DOE/OR/02-1519&D2), feasibility study (DOE/OR/02-1536&D2), and proposed plan (DOE/OR/02-1615&D3).

ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
BHHRA	baseline human health risk assessment
CAP	The Citizen's Advisory Panel
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
COC	contaminant of concern
DNAPL	dense nonaqueous-phase liquid
DOE	U.S. Department of Energy
Envirocare	Envirocare of Utah, Inc.
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
EUWG	End Use Working Group
FFA	Federal Facility Agreement
FR	*Federal Register*
FS	feasibility study
FY	fiscal year
HI	hazard index
ILCR	incremental lifetime cancer risk
LDR	land disposal restriction
LLW	low-level (radioactive) waste
LOC	Local Oversight Committee
LUCAP	Land Use Control Assurance Plan
MCL	maximum contaminant level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
ORR	Oak Ridge Reservation
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RFI	RCRA facility investigation
RI	remedial investigation
ROD	record of decision
S&M	surveillance and maintenance
SARA	Superfund Amendments and Reauthorization Act of 1986

TDEC	Tennessee Department of Environment and Conservation
USC	*United States Code*
VOC	volatile organic compound
WAC	waste acceptance criteria

PART 1. DECLARATION

SITE NAME AND LOCATION

U.S. Department of Energy
K-1070-A Burial Ground (formerly the K-1070-A Old Contaminated Burial Ground Area)
East Tennessee Technology Park (formerly the Oak Ridge K-25 Site)
Oak Ridge Reservation
Oak Ridge, Tennessee

STATEMENT OF BASIS AND PURPOSE

This record of decision (ROD) presents the selected remedial action for the K-1070-A Burial Ground at East Tennessee Technology Park (ETTP) (formerly the Oak Ridge K-25 Site) on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. The action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 *United States Code* (USC) Section 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 *Code of Federal Regulations* (CFR) 300. In accordance with DOE's *Secretarial Policy on NEPA* (DOE 1994), National Environmental Policy Act of 1969 values have been incorporated into CERCLA documentation for this project.

This decision is based on the Administrative Record for the K-1070-A Burial Ground, including the remedial investigation (RI) (DOE 1997a), feasibility study (FS) (DOE 1997b), proposed plan (DOE 1998a), and other documents for this site.

DOE is the lead agency for CERCLA remedial actions on ORR. The U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC are supportive agencies as parties to the ORR Federal Facility Agreement (FFA) for this action. They concur with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy is a source removal action which addresses the present and projected future principal threats posed by the K-1070-A Burial Ground through excavation and permanent disposal of waste in an approved disposal facility. An estimated 19,500 yd^3 of buried waste and associated soil will require excavation. Some waste streams may require treatment to meet Resource Conservation and Recovery Act of 1976 (RCRA) land disposal restrictions (LDRs) or the receiving disposal facility's waste acceptance criteria (WAC).

The major components of the selected remedy are as follows:

- excavation of buried waste and associated soil from the trenches and pits,
- segregation of unbreached containers and cylinders for special processing,
- disposal of most or all excavated material in the ORR on-site disposal facility,
- possible disposal of a relatively small volume of waste at an off-site disposal facility,
- characterization of subsurface soil subsequent to excavation to support future CERCLA decision making for the site, and
- backfilling excavated areas with fill.

CERCLA's 15-month requirement for substantial, continuous, physical on-site action to implement this ROD will be deemed met by the combined activities of starting construction of the ORR on-site disposal facility and awarding the implementation contract for this ROD. Excavation of contaminated material will begin in accordance with the project schedule presented in Table 2.7 in the "Decision Summary" section of this ROD unless modified in accordance with the ORR FFA.

The remedy decision process for this site incorporated a risk-based approach into remedy selection. The selected remedy is a source removal action focusing on excavation of buried waste. No cleanup standards for environmental media were identified for this action. Contaminated soil commingled with the waste as well as visually discolored and disturbed soil adjacent to and underlying the trenches and pits will be removed, but soil is not being addressed as a primary medium of concern.

A final remedy for groundwater and surface water at and downgradient of the K-1070-A Burial Ground is not included in this action; these media will be addressed under subsequent CERCLA decisions. In the interim, DOE, EPA, and TDEC will evaluate the need for action should contaminant concentrations in surface water at downgradient Spring 21-002 exceed ambient water quality criteria (AWQC) (Rules of the TDEC, Chap. 1200-4-3). Any proposed remedy would be presented to the public for review per CERCLA and the FFA.

No known unacceptable residual risk from soils for industrial or recreational land use will remain within the K-1070-A Burial Ground fenced area subsequent to completion of the remedial action defined in this ROD. However, final remedial decisions for soil outside and inside the excavated area within the K-1070-A Burial Ground fenced area will be addressed under subsequent CERCLA decisions to ensure consistency with final land use decisions.

Subsequent to implementation of the remedial action, monitoring and current use restrictions will be maintained for groundwater and surface water as part of ETTP sitewide surveillance and maintenance (S&M) activities until these media are addressed by subsequent CERCLA decisions. Any long-term restrictions or controls required for the site as part of final actions will be documented in accordance with the ORR Land Use Control Assurance Plan (LUCAP) (DOE 1999).

This action does not address restoration or rehabilitation of any natural resource injuries that may have occurred at the site, nor whether such injuries have occurred. In the interim, neither DOE nor TDEC waives any rights or defenses they may have under CERCLA Sect. 107(a)(4)(c).

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, will comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy uses permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. It does not directly meet the statutory preference for remedies that use treatment to reduce toxicity, mobility, or volume as a principal element because no effective treatment technologies were identified in the FS. However, some waste may require treatment to meet LDRs or disposal facility WAC.

The selected remedy effectively addresses the contaminant source at the site by removing the waste. Future CERCLA decisions will address final remedies for surface water and contaminated groundwater beneath and downgradient of the site. A CERCLA 5-year review will not be required for the selected remedy because the waste will be removed from the K-1070-A Burial Ground.

APPROVALS

1/4/2000

Rodney R. Nelson, Assistant Manager
Oak Ridge Operations
U.S. Department of Energy

Date

1/5/2000

Earl C. Leming, Director
U.S. Department of Energy Oversight Division
Tennessee Department of Environment and Conservation

Date

1/13/00

Richard D. Green, Director
Waste Management Division
U.S. Environmental Protection Agency—Region 4

Date

PART 2. DECISION SUMMARY

SITE NAME, LOCATION, AND DESCRIPTION

The 34,516-acre ORR lies within and adjacent to the corporate city limits of Oak Ridge, Tennessee, in Roane and Anderson counties. Oak Ridge is located approximately 12.5 miles west-northwest of Knoxville, 12 miles southwest of Clinton, and 10 miles northeast of Kingston. ORR is bounded to the east, south, and west by the Clinch River (Melton Hill Lake) and by the developed portion of the city of Oak Ridge. ORR hosts three major industrial research and production facilities originally constructed as part of the World War II Manhattan Project: ETTP, Oak Ridge National Laboratory (formerly X- 10), and the Oak Ridge Y-12 Plant.

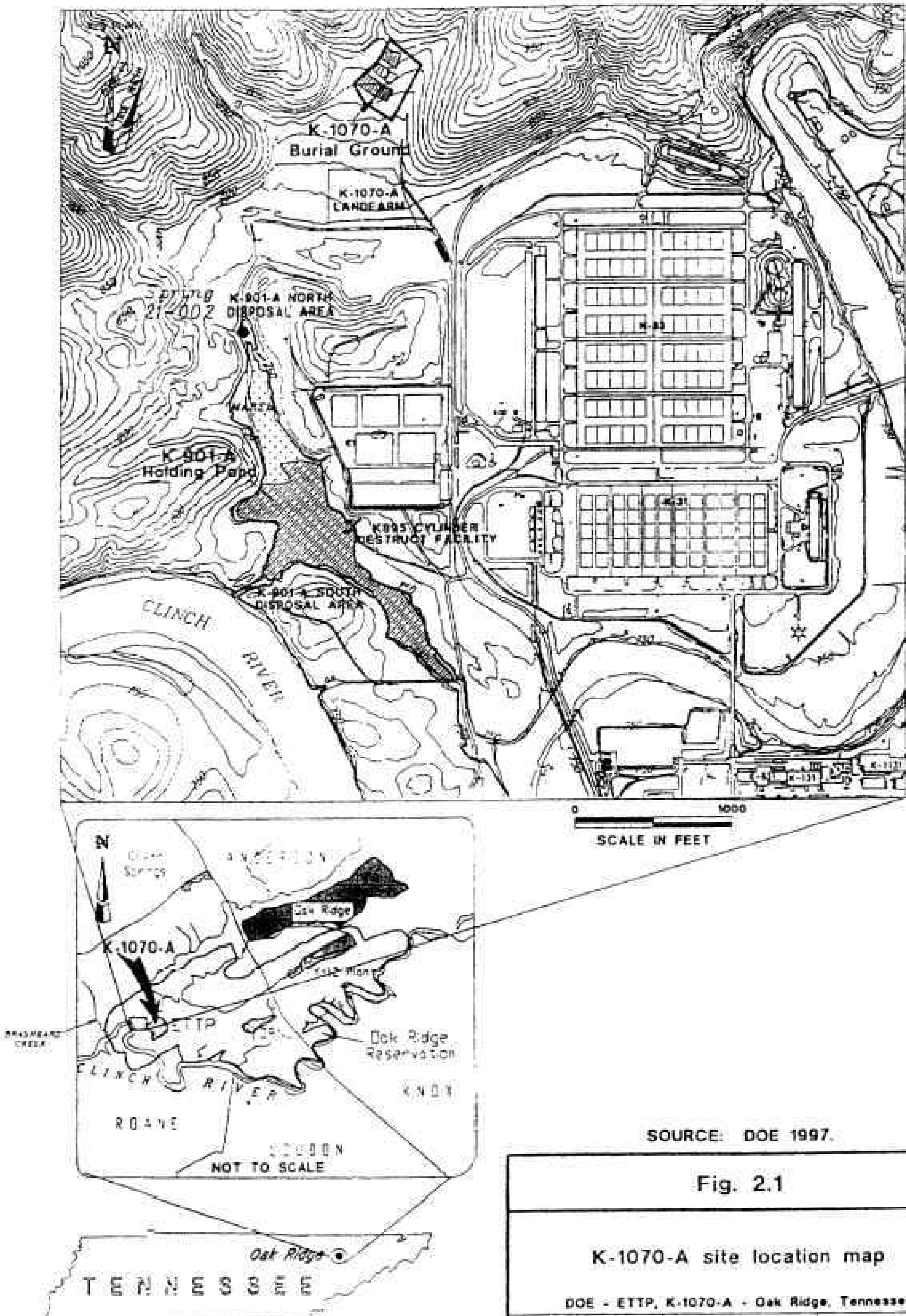
ETTP encompasses approximately 1700 acres of ORR in Roane County, Tennessee. The area surrounding ETTP is used for agricultural, residential, and recreational purposes and is sparsely populated. The K-1070-A Burial Ground consists of approximately 3 acres in the northwest corner of ETTP outside the main plant area on the southern slope of Blackoak Ridge (Fig. 2.1). The burial ground contains largely uranium-contaminated waste from ETTP and other operations buried in unlined trenches and pits (Fig. 2.2). The site consists of several distinct disposal areas with a total of 26 trenches and 62 circular, mechanically augered pits collectively referred to as "graves." The trenches are typically 11 ft deep, 3 ft wide, and 44-102 ft long. The pits are generally 3 ft in diameter and 12 ft deep. The top 4 ft of the trenches and pits were backfilled with soil.

Contamination is present in the trenches and pits and in groundwater beneath and downgradient of the burial ground. Groundwater impacted by contaminants from the burial ground emerges to the south at Spring 21-002, flows into the K-901-A Holding Pond, and subsequently flows into the Clinch River.

The diversity and abundance of animals at the K-1070-A Burial Ground is limited. No threatened or endangered species of plants or animals have been observed. There are no wetlands, historical structures, or archaeological resources on or adjacent to the K-1070-A Burial Ground, and no portion of the burial ground lies within either the 100-year or 500-year floodplain.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

ORR was established in 1942 for the large-scale production of fissionable materials as part of the World War II Manhattan Project. Past ORR activities have generated various wastes that have been managed, stored, and disposed of by various methods. These activities have in some cases resulted in the release of contaminants to the environment. Because of these contaminant releases,



SOURCE: DOE 1997.

Fig. 2.1

K-1070-A site location map

DOE - ETTP, K-1070-A - Oak Ridge, Tennessee

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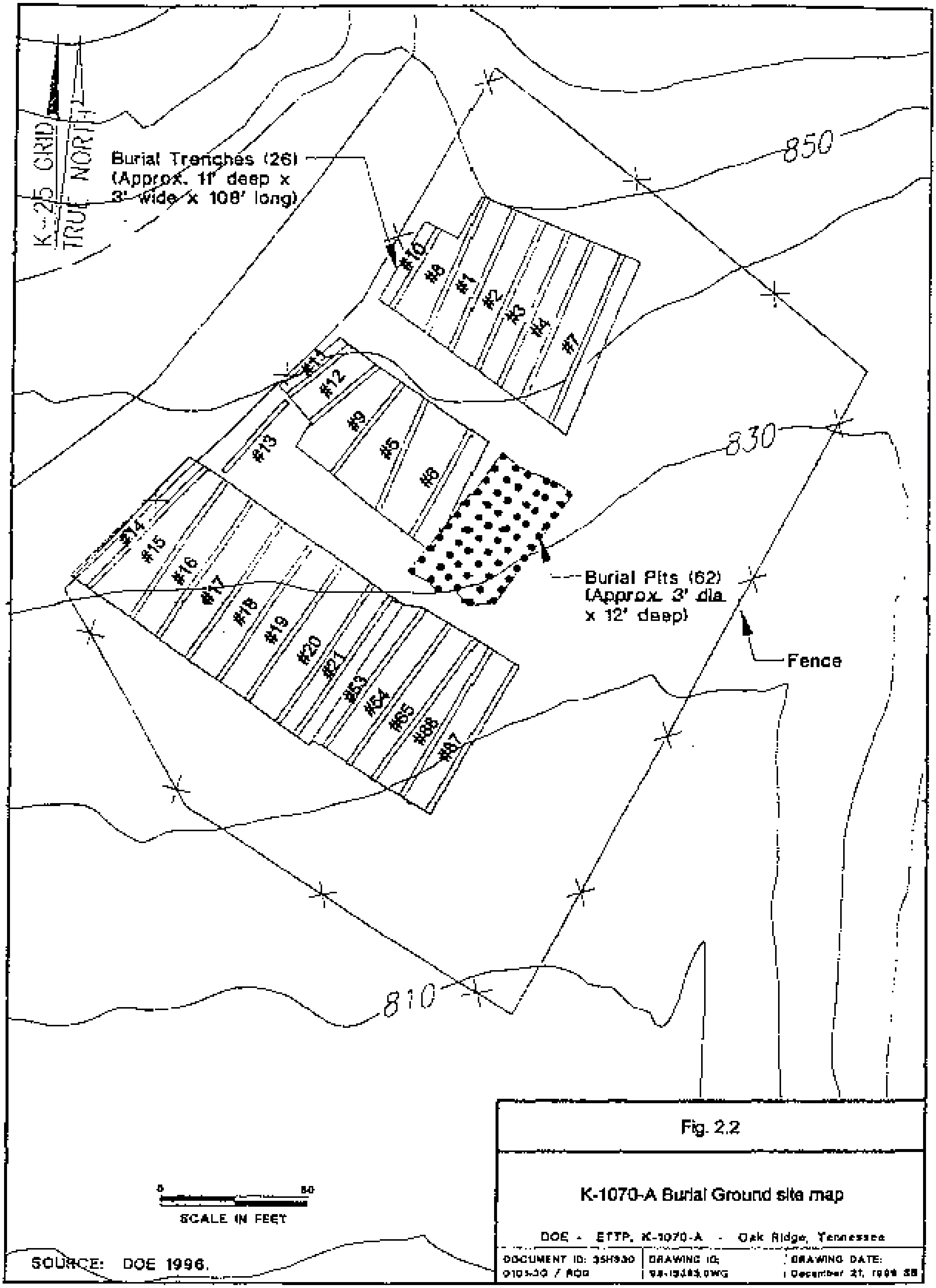

Fig. 2.2

K-1070-A Burial Ground site map

ORR was placed on the EPA National Priorities List established under CERCLA [54 *Federal Register* (FR) 48184, effective December 21, 1989]. Uranium enrichment has historically been the principal mission of ETTP, which remained an active component of the DOE weapons complex until 1985. ETTP operations have generated a variety of radioactive and hazardous waste, some of which has contaminated soils and groundwater.

The K-1070-A Burial Ground received unclassified chemical, radiological, and construction-type wastes from ETTP operations from 1959 to the mid 1980s. Waste from other operations was also disposed of, including waste from outside ORR. The buried waste consists primarily of leached alumina, waste from process and laboratory sources, contaminated containers including uranium hexafluoride (UF_6) cylinders, scrap metals, and waste from construction sources. Leached alumina is the primary waste component of approximately half the trenches and pits. This material originated from the K-25 Building process facility where it was used to remove residual UF_6 and other constituents from air streams before venting to the atmosphere. All waste was containerized and reported to have been disposed of by dumping into unlined trenches and pits. Most, if not all cylinders were breached before disposal.

In 1989, a Phase I RCRA Facility Investigation (RFI) was initiated at the K-1070-A Burial Ground to characterize the nature and extent of contamination in soil, surface water, and groundwater. The RFI concluded that the greatest potential for contaminant migration from the site was via groundwater and that soil did not pose an imminent threat to human health or the environment. Several studies have been conducted at K-1070-A since the 1989 RFI, including a microgravity survey, an electromagnetic survey, a radiological screening survey and associated sampling effort, a rare plant survey, a floodplain assessment, and an evaluation of the potential for karst collapse. RI field activities were initiated in 1994 to further characterize the nature and extent of contamination, define potential exposure pathways, and evaluate human health and environmental risks posed by site contamination. Details of these previous investigations are presented in the RI report (DOE 1997a). The FS (DOE 1997b) used all available site data in developing remedial actions objectives and in developing and evaluating alternatives.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

DOE issued the proposed plan for the K-1070-A Burial Ground for public review on March 16, 1998. DOE published a public notice of availability in *The Oak Ridger, The Knoxville News-Sentinel, The Roane County News, The Clinton Courier,* and other local newspapers within the region of influence March 13-18, 1998. The public notice established a public comment period of March 17 to April 15, 1998. A public meeting was held April 7, 1998, to present the preferred alternative described in the proposed plan and solicit public input. All public comments on the proposed plan are identified and addressed in the "Responsiveness Summary." Part 3 of this ROD.

SCOPE AND ROLE OF THE ACTION

The selected remedy addresses present and potential future threats posed by the K-1070-A Burial Ground through excavating buried waste and associated soil from the trenches and pits and disposal in an approved disposal facility. Source removal eliminates the threat of future contaminant releases or contact with the waste and is consistent with the planned end use of the area for uncontrolled industrial use. Some excavated waste may require treatment to meet LDRs or the receiving disposal facility's WAC.

The selected remedy is a source removal action focusing on excavation of buried waste. No cleanup standards for environmental media were identified for this action. Contaminated soil commingled with the waste as well as visually discolored and disturbed soil adjacent to and underlying the trenches and pits will be removed, but soil is not being addressed as a primary medium of concern.

The following elements are not conclusively addressed in this ROD, but will be addressed as part of future CERCLA decisions:

- soil outside the excavated area within the K-1070-A Burial Ground fenced area,
- groundwater beneath and downgradient of the site,
- downgradient surface water impacted by site contaminants,
- downgradient sediments, and
- definition of any long-term restrictions or controls required at the site.

Based on agreement among DOE, EPA, and TDEC subsequent to release of the proposed plan, groundwater is deferred to future CERCLA decisions (see "Documentation of Significant Changes" in Part 2 of this ROD). The proposed plan also called for a contingent surface water remedy (for action alternatives) to be implemented in the case that contaminant concentrations at Spring 21-002 exceed AWQC. Instead, should these standards be exceeded, DOE, EPA, and TDEC will evaluate the need for action and present any proposed remedy for public review per CERCLA and the FFA. Following implementation of the remedial action, monitoring and current use restrictions will be maintained for groundwater and surface water as part of ETTP sitewide S&M activities until these media are addressed by subsequent CERCLA decisions. The monitoring plan will be defined in the appropriate CERCLA documentation (i.e., the remedial action report).

This response action fits into the overall ORR cleanup strategy by removing and disposing of contaminated media to the extent practicable, thereby meeting the following Paths to Closure (DOE 1998b) goals:

- environmental restoration that protects human health and the environment by addressing the remediation of buried waste and contaminated media,

- waste management that provides for the safe and secure disposal of waste, and

- reduction of S&M requirements.

The action is also consistent with the ORR End Use Working Group (EUWG) *Community Guidelines for End Uses of Contaminated Properties* (DOE 1997c) which recommends that "[i]nstitutional controls in lieu of remedial actions should be used only in cases where DOE has satisfied the community that further restoration is not feasible," and "[e]nd use decisions should strive to reduce the amount of land requiring long-term control."

Remedial actions completed to date at the K-901-A Holding Pond, located downgradient of the K-1070-A Burial Ground, consist of draining the pond, harvesting and disposing of contaminated fish, and removing cylinders. Contaminated sediments in the pond have not been addressed, and the final decision regarding remediation of these sediments will be deferred until the K-1070-A Burial Ground action is complete. This sequencing will allow any potential impacts from this remedial action to be incorporated into final remedial decisions for the K-901-A Holding Pond.

As part of its overall ORR cleanup strategy, DOE has evaluated various disposal alternatives for ORR cleanup wastes under a separate CERCLA project. This evaluation ultimately resulted in the November 1999 FFA Tri-party approval of a ROD to construct a large-scale disposal facility on ORR to accept most of the cleanup wastes. The selected remedy for the K-1070-A Burial Ground includes disposing of most or all excavated waste at this facility. A relatively small volume of waste may not be amenable to treatment to meet the WAC for the on-site disposal facility and require disposal off site. Selection of an off-site disposal facility and the type(s) of treatment potentially required to meet LDRs or disposal facility WAC were not considered in evaluations supporting this ROD but are within the scope of this action. If required, they will be selected during implementation and specified in post-ROD documentation.

SUMMARY OF SITE CHARACTERISTICS

The K-1070-A Burial Ground lies on a gentle slope of the wooded southeast flank of Blackoak Ridge in the northwest corner of ETTP. The relatively flat disposal area is bounded to the west and east by shallow drainage ditches and is maintained by mowing and filling low surface areas with soil. Vegetation inside the fenced area is dominated by grasses and other herbaceous plants that provide habitat for small mammals [e.g., the Short-tailed shrew (*Blarina brevicauda*) and White-footed mouse (*Peromyscus leucopus*) and birds [e.g., the American robin (*Turdus migratorius*) and Song sparrow (*Melospiza melodia*)]. Most of the nearby area supports relatively mature second-growth forests. No threatened or endangered species have been reported at the site. No wetlands, historical buildings, or archaeological sites are located on or immediately adjacent to the burial ground.

The geology and groundwater flow beneath the K-1070-A Burial Ground are complex. The trenches and pits lie within clay residuum, which hosts numerous chert layers that transmit water to and from the underlying karst aquifer. Most groundwater beneath the burial ground moves through karst bedrock to springs feeding the K-901-A Holding Pond. The groundwater table fluctuates up to 40 ft seasonally, partially filling approximately half of the trenches and pits. Water briefly pools in some of the trenches and pits following storms. Water passing downward out of the trenches and pits carries contaminants into the groundwater.

The K-901-A Holding Pond, located south and downgradient of the K-1070-A Burial Ground (Fig. 2.1), is fed primarily by a stream that carries water from several springs and ETTP stormwater runoff. Groundwater carrying contaminants from the burial ground emerges at Spring 21-002 (2000 ft south-southwest), which flows into the K-901-A Holding Pond and subsequently into the Clinch River.

Leachate samples taken during the RI and waste inventory records suggest that the trench and pit waste is heterogeneous. Buried wastes consist of unclassified chemical, radiological, and construction-type wastes, including radioactive sources, large cylinders, and drums and glass containers with possible flammable liquids. The buried waste falls into five general categories: leached alumina (47 percent), waste from process and laboratory sources (14 percent), contaminated containers (including cylinders) and scrap materials (8 percent), waste from construction sources (27 percent), and similar waste from sources outside ETTP operations (3 percent).

Leached granular alumina contains residual uranium compounds, ^{99}Tc, and nitric acid. Process and laboratory waste contain radionuclides including Pu, Th, U, and Tc; Be and other metals; and organic compounds.. Buried containers range from 5-gal cans and buckets to 55-gal drums to cylinders of various designs and capacity. Construction wastes are primarily roof and stack materials that are likely contaminated with uranium, metals, and potentially acids or solvents. Containerized liquid wastes, including Miller's Fluorinated Lubricating Oil and laboratory chemicals, are known to have been disposed of at the burial ground. The majority of the buried waste is expected to be radioactively contaminated and therefore classified as low-level (radioactive) waste (LLW). Based on disposal records, drive point samples conducted as part of the RI, and detection of contaminants that have migrated from the site, a portion of the trench and pit material is known to contain RCRA constituents. Disposal records for the burial ground are incomplete and may not identify all wastes present.

Soil, groundwater, and surface water are known to be contaminated with hazardous and radioactive contaminants that have migrated from the K-1070-A Burial Ground. Minimal contamination has been detected in the surface soil, with significant contaminants of concern (COCs) limited to ^{208}Tl, ^{214}Bi, and ^{214}Pb. ["Significant" COCs are defined as those that pose a risk $\geq 1 \times 10^{-4}$ incremental lifetime cancer risk (ILCR) or a hazard index of (HI) 1, or contribute at least 10 percent of the risk/hazard for a medium that has an ILCR $\geq 1 \times 10^{-4}$ or an HI of 1 (DOE 1997a).] Uranium-238, ^{99}Tc, and volatile organic compounds (VOCs) have been detected in subsurface soil with the greatest concentrations at 30-50 ft deep. These contaminants are not considered significant COCs in subsurface soil because of their low concentrations and the lack of an exposure pathway. Based on available data, contaminants in soil are limited to the area immediately surrounding the trenches and pits.

Figure 2.3 shows locations at the K-1070-A Burial Ground from which soil borings were collected for the RI and previous sampling efforts. Based on baseline human health risk assessments (BHHRAs) conducted for the site, only two sampling locations within the fenced area have an estimated industrial risk from surface soil that exceeds the EPA target risk range (1×10^{-6} to 1×10^{-4} ILCR). These locations (RAD 325 and RAD 326) were sampled as part of the 1994 ETTP sitewide radiological screening survey (CDM 1995), which identified and characterized radiological hot spots at inactive facilities. These points are located within the lateral bounds of the trenches and pits and will be removed. The resulting industrial risk from surface soil based on aggregated site data is within the EPA target risk range.

Releases have contaminated groundwater beneath and downgradient of the burial ground. Average groundwater concentrations for trichloroethene and other VOCs exceed Safe Drinking Water Act of 1974 maximum contaminant levels (MCLs). Maximum ^{99}Tc and ^{235}U concentrations detected in groundwater exceed MCLs for gross beta and gross alpha activity, but average radionuclide concentrations are well below these existing standards (Table 2.1). Based on analysis of the site geology and results from groundwater sampling, dense nonaqueous-phase liquid (DNAPL) may have entered the bedrock aquifer beneath the burial ground.

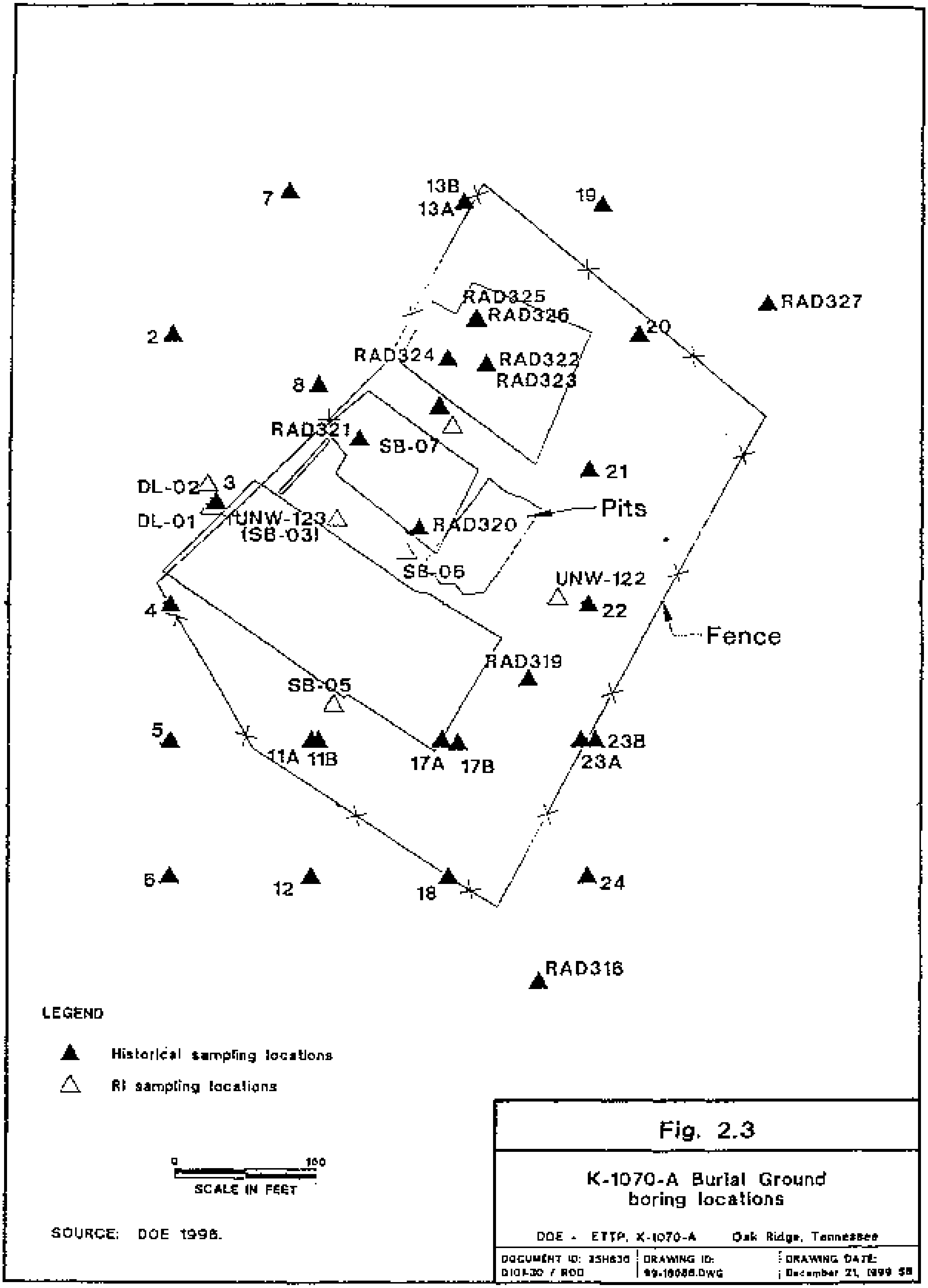

Fig. 2.3

K-1070-A Burial Ground boring locations

SOURCE: DOE 1996.

Table 2. 1. Groundwater exceedances of MCLs (Fg/L), East Tennessee Technology Park, Oak Ridge, Tennessee

Contaminant	MCL[a]	Unconsolidated groundwater[b]	Bedrock groundwater[b]
Benzene	5	10	NA
Carbon tetrachloride	5	360	340
1,1-Dichloroethylene	7	1,000	64
Dichloromethane	5	45	5
Lead	TT (MCLG = 0.0)	15.9	0.95
Nickel	100[c]	161	NA
Tetrachloroethylene	5	59	110
Thallium	2	NA	5.4
1,1,1-Trichloroethane	200	1,100	NA
1,1,2-Trichloroethane	5	89	NA
Trichloroethylene	5	3,400	3,600
Gross alpha	15 pCi/L	NA	83.1 pCi/L
Gross beta	4 mrem/year	3,700 pCi/L[d]	7,870 pCi/L[d]
All other man-made radionuclides	4 mrem/year	^{99}Tc = 3,700 pCi/L[4]	^{99}Tc = 810,000 pCi/L[4]

[a]Federal and state maximum contaminant levels were evaluated. MCLs are federal standards unless noted otherwise.
[b]Groundwater data are from the *Remedial Investigation of the K-1070-A Burial Ground at East Tennessee Technology Park, Oak Ridge, Tennessee Volume 1. Report* (DOE/OR/01-1519/V1&D2) Tables 3.10 and 3.11.
[c]State criterion only.
[d]4 mrem ^{99}Tc = 900 pCi/L.

L= liter
MCL = maximum contaminant level
MCLG = maximum contaminant level goal
Fg - microgram
mrem = millirem
NA - not applicable (no exceedance of MCL noted)
pCi = picocurie
Tc = technetium
TT = treatment technique

Contaminants detected in surface water at Spring 21-002 were screened against both AWQC regulatory thresholds and CERCLA risk-based thresholds. AWQC include numeric criteria developed for the protection of water quality under the mandate of the Clean Water Act of 1972 and are enforced by the TDEC Division of Water Pollution Control. While no contaminant concentrations in surface water at Spring 21-002 exceed AWQC regulatory thresholds, there are risk-based COCs that exceed the EPA target risk range, including 1,1-dichloroethane and ^{224}Ra. Additionally, modeling conducted as part of the RI (DOE 1997a) predicts that concentrations of ^{99}Tc, U isotopes, Mn, and several VOCs in the spring may increase to unacceptable levels in the future.

High concentrations of contaminants detected in the trenches and pits indicate that they are a continuing source of contamination. The deterioration of currently intact containers presents the potential for sudden future releases. Such releases could pose a risk to off-site receptors because local groundwater flow provides a rapid transport pathway for contaminants leached from the burial ground.

SUMMARY OF HUMAN AND ECOLOGICAL RISKS

The RI included a BHHRA and ecological risk assessment to determine any current or future adverse impacts from exposure to contaminated media at the site. These assessments quantified potential risks from contaminated soils, surface water, groundwater, and exposure to radiation. While risk from direct exposure to the trench and pit materials was not quantified, inhalation of, ingestion of, or direct contact with these materials would result in unacceptable human health risk. The presence of these wastes is inconsistent with less restricted future land use.

Human health risks were quantified for five land-use scenarios: (1) future on-site resident, (2) future on-site resident that excavates, (3) future recreational use, (4) current industrial worker, and (5) future industrial worker. Table 2.2 summarizes human health risks and significant COCs for these five land use scenarios.

Eight endpoints were evaluated for the ecological risk assessment:

- Reduction in abundance or production of omnivorous and vermivorous mammal populations, represented by the White-footed mouse and Short-tailed shrew, respectively

- Reduction in abundance or production of White-tailed deer populations using a suspected deer lick

- Reduction in production of terrestrial plant communities

- Reduction in production of wetland plant communities

- Reduction in species richness or abundance in fish communities

- Reduction in abundance of individual piscivorous wildlife, represented by the mink

- Reduction in abundance of soil invertebrates

Table 2.2. Summary of baseline risk for K-1070-A Burial Ground, East Tennessee Technology Park, Oak Ridge, Tennessee

Scenario	Maximum risk	Maximum hazard index	Significant COCs
Groundwater			
Future residential	7.6×10^{-2}	1.7×10^{-1}	1,1-DCE, TCE carbon tetrachloride, As, chloroform, ^{99}Tc, PCE, 1,1,1-TCA, 1,1,2-TCA
Surface water			
Future residential	5.4×10^{-4}	2.7×10^{-2}	^{224}Ra, 1,1-DCE
Future recreational	2.2×10^{-6}	NA	NA
Soils			
Current industrial	5.1×10^{-6}	7.6×10^{-2}	NA
Future residential	2.6×10^{-4}	3.1×10^{-1}	^{208}TI, ^{214}Bi, ^{214}pb
Future excavation	4.2×10^{-7}	1.3×10^{-1}	NA
Future industrial	5.1×10^{-5}	1.3×10^{-1}	NA
Future recreational	2.6×10^{-6}	3.7×10^{-1}	NA

COC = contaminant of concern
NA = not applicable

- Reduction in viability or fecundity of individuals of any federal- or state-listed threatened or endangered species

Hazard quotients (HQs) for each assessment endpoint were derived by dividing contaminant concentrations by their respective benchmark values. The exposure point concentration for shrews reflected maximum concentrations in earthworms measured on site. An HQ > 1 indicates the potential for unacceptable risk to the endpoint evaluated. The assessment endpoints evaluated and the results of the ecological risk assessment are provided in Table 2.3.

Results of the BHHRA and the ecological risk assessment are summarized here:

- Human health risks for future residents at the burial ground would be unacceptable because of external exposure to radionuclides in surface soils and inhalation and ingestion of VOCs, arsenic, and radionuclides in groundwater.

- Estimated cumulative risks to the current industrial worker, future industrial worker, and future recreational user are 5.1×10^{-6}, 5.1×10^{-5}, and 4.8×10^{-6}, respectively.

Table 2.3. Summary of ecological risks by assessment endpoint

Assessment endpoint	Minimum HQ	Maximum HQ[a]	Contaminants of ecological concern	Affected media
Mice and shrews [b]	<0.01	2.79 5.75 5.30 6.12	Antimony, PCB-1254, PCB-1260, Selenium	Surface Soil
Deer [c]	<0.01	0.29	N/A	Surface Soil
Terrestrial plants [d]	<0.01	1	Selenium	Surface Soil
Wetland plants [e]	0.3	0.3	N/A	Surface Water
Fish [f]	<0.01	0.78	N/A	Surface Water
Piscivorous [g]	0.085	0.11	N/A	Surface Water
Soil invertebrades [b]	0.01	0.08	N/A	Surface Soil
Threatended and endangered species [i]	N/A	N/A	N/A	N/A

[a] Based on lowest observable adverse effect level
[b] Reduction in abundance or production of White-footed mouse or Short-tailed shrew populations
[c] Reduction in abundance or production of White-tailed deer populations
[d] Reduction in production of terrestrial plant communities
[e] Reduction in production of wetland plant communities
[f] Reduction in species richness or abundance in fish communities
[g] Reduction in abundance of individual piscivorous wildlife
[h] Reduction in abundance of soil invertebrates
[i] Reduction in viability or fecundity of individuals of any federal- or state-listed threatened or endangered species

HQ = hazard quotient
N/A = not applicable

- Administrative controls in place at the site are protective of human health by limiting current exposures. However, loss of institutional controls could result in uncontrolled exposures to the trench and pit material by human or ecological receptors. In addition, contaminants are migrating from the trench and pit material and will present unacceptable future risks to humans who use groundwater or surface water as a drinking water source.

- Surface water contaminated by releases from the K-1070-A Burial Ground does not present an unacceptable risk to potential recreational water users at current contamination levels.

- Future contaminant releases may increase. Evidence suggests some potential for karst subsidence, with a minimal potential for collapse, that could release greater amounts of contaminants. Deterioration of currently intact containers could also result in an increase in contaminant releases.

- Modeling predicts that contaminant concentrations in surface water at Spring 21-002 will increase and may pose an unacceptable future risk to human health associated with ingestion or inhalation of VOCs and radionuclides.

- Site contamination poses minimal current risks to the environment.

- Selenium was detected at one sampling location (SB-07) at a concentration reported to be toxic to plants.

- Contaminants in surface soil do not pose a risk to soil invertebrates, although selenium, antimony, and PCBs (Aroclor-1254 and Aroclor-1260) have accumulated in earthworms at concentrations that may pose an ingestion risk to Short-tailed shrews.

- Neither current nor modeled contaminant concentrations in Spring 21-002 pose unacceptable risk to piscivores or wetland plants. Current contaminant concentrations in Spring 21-002 do not pose a risk to fish, but modeling results indicate that future risk may be posed by copper and carbon tetrachloride.

- Surface soil from a suspected deer lick located along a ditch running parallel to the west fence does not pose a risk to deer.

- Radionuclides do not pose a risk to any ecological endpoint.

While human health and ecological risk were estimated using the best available data, there are uncertainties that limit the ability to accurately estimate future risk associated with site contaminants. These uncertainties include the incomplete waste inventory for the trenches and pits and uncertainties associated with future contaminant releases from subsidence at the site and the deterioration of currently intact containers. Only a permanent remedy such as source removal can ensure that future risks at the site will be acceptable. Specific media risks will be addressed under future CERCLA decisions.

DESCRIPTION OF ALTERNATIVES

Alternatives were developed in the FS (DOE 1997b) to meet the following remedial action objectives (RAOs), which were established for K-1070-A based on results of the risk assessment:

- control human exposure to contamination;
- prevent human and ecological exposure to contamination;
- reduce contamination; or
- remove the source of contamination (i.e., trench and pit material).

Technologies were grouped together to satisfy one or more of these RAOs. These technologies were screened for applicability, then evaluated for implementability, effectiveness, and cost—the key CERCLA evaluation criteria. Representative technologies were selected and assembled into a range of alternatives. These alternatives were then screened to develop a shorter list of alternatives for detailed development and analysis. Following are the five alternatives carried forward for detailed development and analysis in the FS:

- Alternative 1: No action
- Alternative 2: Waste containment and institutional controls
- Alternative 3: Waste containment, hydraulic isolation, and institutional controls
- Alternative 4: Waste removal and disposal and institutional controls
- Alternative 5: Waste removal and disposal and extensive groundwater treatment

None of the technologies or alternatives were designed to address possible free-phase DNAPL in the bedrock because no known technologies can successfully locate, treat, or remove this type of contaminant from a karst aquifer. The remedial alternatives are described in the paragraphs that follow. The costs of these alternatives are presented in the "Summary of Comparative Analysis of Alternatives" section.

Alternatives 3 and 5 are presented here as they were in the proposed plan (DOE 1998a) with regard to remedy components that address groundwater at the site. As discussed in the "Scope and Role of the Action" and "Documentation of Significant Changes" sections of this ROD, groundwater actions and contingent action for surface water at Spring 21-002 have been deferred to future CERCLA decisions in accordance with agreement among EPA, TDEC, and DOE made subsequent to release of the proposed plan.

ALTERNATIVE 1: NO ACTION

CERCLA requires evaluation of the no action alternative to provide a baseline for comparison with other alternatives. Under this alternative, no action would be taken at the site and all contaminated media would remain in place. Current institutional controls would not be maintained, allowing unrestricted future land use and access to the site, and potential exposure to waste and contamination.

ALTERNATIVE 2: WASTE CONTAINMENT AND INSTITUTIONAL CONTROLS

This alternative consists of constructing a multilayer cap over the trenches and pits and institutional controls including long-term media monitoring, S&M, fencing, groundwater and surface water use restrictions, and administrative controls. The K-1070-A Burial Ground would be designated a no use zone. No future residential, recreational, agricultural or industrial activities would be permitted on the site. Only S&M personnel would be allowed access to the capped area.

The cap would consist of a layer of grading/fill material, a low-permeability liner, a drainage layer, and a vegetative layer. Cap inspection and surface water and groundwater monitoring would be conducted semiannually. Best management practices would be used during construction to minimize adverse effects to workers and the environment. DOE, EPA, and TDEC would evaluate the need for action should contaminant concentrations at Spring 21-002 exceed the regulatory thresholds of the AWQC. Any proposed remedy would be presented to the public for review.

ALTERNATIVE 3: WASTE CONTAINMENT, HYDRAULIC ISOLATION, AND INSTITUTIONAL CONTROLS

This alternative consists of constructing a multilayer cap over the trench and pit material, installing horizontal drains below the burial ground, installing collection basins and sumps, transporting collected groundwater by pipes and trucks, water treatment, and administrative controls, fencing, physical S&M, and long-term monitoring. This alternative would result in the K-1070-A Burial Ground being designated a no use zone.

The horizontal drain system would consist of perforated pipes buried approximately 25 ft deep, oriented to drain downslope into a collection trench. A storage tank would hold groundwater pending truck shipment for treatment and discharge. If contaminants in the collected groundwater fall below MCLs, storage, transport, and treatment would discontinue and the water would be discharged at the surface. Capping and other activities, including fencing and land use/access restrictions, would be the same as in Alternative 2. Surface water contamination at Spring 21-002 would also be addressed as described for Alternative 2.

ALTERATIVE 4: WASTE REMOVAL AND DISPOSAL AND INSTITUTIONAL CONTROLS

Alternative 4, DOE's preferred alternative, consists of excavating approximately 19,500 yd^3 of waste and associated soil from the trenches and pits and disposal in the ORR on-site disposal facility. A relatively small volume of waste may not be amenable to treatment to meet the WAC for the on-site disposal facility and require disposal off site. Surface water contamination at Spring 21-002 would be addressed as described for Alternative 2.

During excavation, protective measures and sampling devices would be used. Special precautions would be implemented as needed during excavation and handling to protect against dangers associated with the waste. Adherence to as low as reasonably achievable (ALARA) principles would minimize worker exposure to radiological contaminants. As the waste is excavated, unbreached containers and cylinders would be segregated for special processing. Treatment of some waste may be required to meet LDRs or disposal facility WAC.

DOE has evaluated disposal alternatives for ORR environmental restoration wastes under a separate CERCLA project. This evaluation ultimately resulted in the November 1999 FFA Tri-party approval of a ROD to construct a large-scale disposal facility within the ORR boundary for the majority of waste generated from environmental restoration activities. This alternative assumes that most or all waste excavated from the K-1070-A Burial Ground would be disposed of in this facility.

Monitoring and use restrictions for groundwater and surface water as part of ETTP sitewide S&M activities would follow implementation of this action.

ALTERNATIVE 5: WASTE REMOVAL AND DISPOSAL AND EXTENSIVE GROUNDWATER TREATMENT

This alternative would be implemented in two phases, with a delay after the first phase to determine whether the second phase (groundwater treatment) is necessary. Phase I consists of excavating and disposing of trench and pit material in the ORR on-site disposal facility as described in Alternative 4. Phase II consists of groundwater collection and treatment through use of horizontal drains that divert groundwater through a reactive treatment media. Surface water contamination at Spring 21-002 would be addressed as described for Alternative 2.

Phase II groundwater actions would be implemented if groundwater contaminant concentrations were to still exceed regulatory levels approximately 3 years after implementation of Phase I. The horizontal drains installed would be similar to those in Alternative 3 with three exceptions: (1) collection piping would be deeper (about 40 ft deep); (2) a catch basin would be constructed to distribute groundwater to an in situ treatment system instead of collecting groundwater in a tank for transport and ex situ treatment: and (3) groundwater from the catch basin would flow through treatment media in a reactive gate. Treated water would be discharged to the nearest surface water body.

Implementation of this alternative would eliminate many of the land use restrictions associated with the other alternatives.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

CERCLA requires that a detailed analysis be performed to determine the most suitable alternative. EPA has identified nine criteria for evaluating remedial action alternatives, which are addressed in this ROD. The first two, overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs), are threshold criteria that must be met by any alternative considered in a ROD. The next five criteria form the primary balancing criteria: short-term effectiveness; long-term effectiveness; reduction of toxicity, mobility, and volume through treatment; implementability; and cost. The last two criteria, state acceptance and community acceptance, incorporate regulatory agency review and public comments. The comparative analysis of the five alternatives considered for the K-1070-A Burial Ground is discussed in the following subsections. Table 2.4 summarizes the comparative analysis.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 would not protect human health because no action would be taken and unacceptable risks could result from direct exposure to the trench and pit material or the use of downgradient groundwater or surface water. Without site maintenance, the soil backfill over the trenches and pits could erode and possibly expose the buried wastes to the environment.

Alternatives 2)5 would protect human health and the environment by minimizing direct contact with the trench and pit material through access restrictions, a multilayer cap, or removal of the contaminated material. Risks from using groundwater or surface water would be mitigated through use restrictions for all action alternatives. Alternatives 3 and 5 would provide slightly more protection from groundwater contamination. Alternatives 4 and 5 would provide more permanent protection through removal of the trench and pit material, eliminating the potential for unacceptable risk from direct exposure to waste and the potential for future contaminant releases. Residual risk for Alternatives 2)5 would be within or below the EPA target risk range of 1×10^{-6} to 1×10^{-4} ILCR for anticipated land use.

Table 2.4. Comparative analysis summary, K-1070-A Burial Ground, East Tennessee Technology Park, Oak Ridge, Tennessee

Criteria	Alterative1—No Action	Alternative 2—Waste containment and institutional controls	Alternative 3—Waste containment, hydraulic isolation, and institutional controls	Alternative 4—Waste removal and disposal and institutional controls	Alternative 5—Waste removal and disposal and extensive groundwater treatment
Threshold criteria					
Overall protection of human health and the environment	Not protective	Protective	Protective	Protective	Protective
Compliance with ARARs	NA	Meets ARARs (groundwater deferred)	Meets ARARs (groundwater deferred)	Meets ARARs (groundwater deferred)	Meets ARARs (groundwater deferred)
Balancing criteria					
Long-term effectiveness and permanence	Not effective	Protective of human health and the environment through capping and institutional controls. Effective in reducing the potential for contaminated soil erosion and exposure to trench and pit material	Effective in isolating contaminants and reduces the potential for additional releases. Restrictions required. Extensive surveillance and maintenance required for groundwater collection and treatment system	Waste removal effectively eliminates risk from trench and pit material over the long term. Effectiveness of disposal is high	Similar to Alternative 4. Long-term effectiveness and reliability are the highest of all the alternatives
Reduction of toxicity, mobility, and volume through treatment	No treatment	No significant treatment	Treatment of collected groundwater. Mobility and volume of contaminants are reduced	Some waste may require treatment to meet LDRs or the receiving disposal facility WAC	Removes more contaminants than other alternatives. Reactive gate reduces mobility of inorganics, and toxicity and volume of organics; some waste may require treatment to meet LDRs or the receiving disposal facility WAC
Short-term effectiveness	No increase in short-term risks or impacts to the environment	Minimal waste disturbance. No off-site waste transportation. Minimal environmental impacts due to short duration of remedation activities	Slightly more short-term impacts than Alternative 2	Impacts to workers, community, and the environment are higher than for Alternatives 2 and 3 because of extensive waste handling and transport	Slightly greater impacts than Alternative 4 should Phase II be required

Table 2.4 (continued)

Criteria	Alternative 1) No action	Alternative 2) Waste containment and institutional controls	Alternative 3) Waste containment, hydraulic institutional controls	Alternative 4) Waste removal and disposal and institutional controls	Alternative 5) Waste removal and disposal and extensive groundwater treatment
Implementability	Implementaion not required	Easy to implement. Capping is a proven technology; physical barriers and groundwater monitoring wells are already in place	Cap materials and equipment are readily available and caps are easy to install. Drain installation would be slightly difficult, but equipment and expertise are available	Somewhat difficult. Excavation of trench and pit material may require extensive waste characterization. Equipment and labor are ready available. Disposal requires waste transportation. Off-site waste transport, if required, may be more administratively difficult than on-site transport	Same as Alternative 4 for excavation and disposal of waste. Drain and gate installation are difficult
Cost					
Present worth capital cost	No cost	$2.0 million	$6.7 million	$18.7 million	$24.2 million
Present worth O&M cost	No cost	$830,000	$1.5 million	$900,000	$1.7 million
Total		**$2.8 million**	**$8.2 million**	**$19.6 million**	**$25.9 million**

ARAR = applicable or relevant and appropriate requirement

$ = dollar

LDR = land disposal restriction

NA = not applicable

O&M = operation and maintenance

WAC = waste acceptance criteria

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

There are no ARARs for Alternative 1. Alternatives 2-5 would comply with all ARARs. ARARs referenced in this ROD address source remediation and do not address remediation of surface water or groundwater. ARARs for these media will be addressed as required under future CERCLA decisions.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 would not provide long-term effectiveness. Through capping and use restrictions, Alternatives 2 and 3 would provide long-term protection against exposure to the pit and trench material. The cap would reduce infiltration; however, the groundwater pathway between the waste and the underlying karst bedrock would remain, limiting the long-term effectiveness of these alternatives. Through collection and treatment of groundwater from the unconsolidated zone, Alternative 3 adds some protection from further contaminant releases. However, techniques for groundwater collection using horizontal wells have not been completely developed and effectiveness is uncertain.

Because waste would be removed, Alternatives 4 and 5 are the most effective and permanent in preventing exposures to trench and pit material. Alternative 5 would address groundwater contamination more aggressively than the other alternatives, but its effectiveness is uncertain. If present, DNAPL in bedrock will continue to contaminate groundwater regardless of the actions implemented. Therefore, all alternatives rely on continued sitewide institutional controls to prevent use of groundwater and surface water. Any long-term restrictions or controls required for the site as part of final actions will be documented in accordance with the ORR LUCAP (DOE 1999).

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

There is no treatment under Alternative 1. Alternatives 2-5 would involve surface water treatment only if required for Spring 21-002. Alternative 3 includes treatment of groundwater at the Central Neutralization Facility that would slightly reduce the volume and mobility of contaminants; however, toxicity would not be altered. Alternative 5 includes in situ treatment of groundwater in a reactive gate, thereby reducing the volume of contaminated water leaving the site and the mobility and toxicity of some contaminants. Treatment of some excavated waste may be required to meet LDRs or disposal facility WAC under Alternatives 4 and 5.

SHORT-TERM EFFECTIVENESS

Short-term effectiveness addresses impacts during remedial action, including protection of the community and workers, effects on the environment, and socioeconomics and land use. For Alternative 1 there would be no increase in short-term risk or impacts to the environment. For Alternatives 2-5, risks to workers and the community would be controlled to acceptable levels.

Alternatives 2 and 3 would have fewer short-term impacts than Alternatives 4 and 5 because trench and pit material would not be disturbed or transported. Transportation of soil, capping materials, pipes, and construction and drilling equipment would have minimal short-term impacts to the nearby community. The short duration of activities and minimal disturbance of contaminated materials would result in low risks to on-site remediation workers. Of the action alternatives, Alternative 2 would cause the least short-term impacts to human health or the environment. Alternative 3 would cause slightly more short-term impacts.

The potential for risk to the community, environment, and remediation workers for Alternatives 4 and 5 are higher than for the other alternatives. During excavation, measures would be implemented to protect against dangers associated with the waste and adherence to ALARA principles would minimize worker exposure. Waste excavation and transport would slightly increase the risk to the nearby community from truck traffic and potential accidents. Transportation risk would be greater if waste were disposed of off site rather than at the ORR on-site facility. Potential adverse environmental effects for Alternatives 4 and 5 include increased sediment loading and soil erosion; however, erosion control measures would effectively mitigate potential releases. Implementation of Alternatives 4 and 5 could have positive local socioeconomic impact if the reduction in land use restrictions afforded by the removal of waste resulted in beneficial reuse of the K-1070-A site.

IMPLEMENTABILITY

All of the alternatives are implementable. Alternative 1 does not require implementation. Cap construction for Alternative 2 would be the easiest action to implement, and physical barriers and groundwater monitoring wells are already in place. The additional actions of horizontal drain installation and groundwater collection and treatment for Alternative 3 are more complex than capping, but are readily implementable using standard technologies. Alternatives 4 and 5 are more difficult to implement because of safety concerns during excavation of trench and pit material. Alternative 5 is the most difficult to implement because it requires both waste removal and groundwater collection and treatment.

Alternatives 4 and 5 require the availability of a suitable waste disposal facility. Most or all of the excavated trench and pit material is expected to meet the ORR on-site disposal facility WAC. Off-site disposal would be implementable for the volume of waste that could not be treated to meet the WAC for the on-site disposal facility.

COST

Total remediation costs are estimated as present worth costs, which represent the amount of money required for investment, in current year dollars, to fund an alternative through completion. The total cost includes direct, indirect, and operation and maintenance (O&M) costs. Table 2.4 shows the present worth costs for the five alternatives evaluated for K-1070-A. These estimates do not include cost for any contingent remedial actions. In accordance with EPA guidance, the estimates assume 30 years of monitoring and maintenance (reflected under O&M cost presented in Table 2.4).

There is no cost associated with Alternative 1. Alternative 2 is the least expensive action alternative and Alternative 5 is the most expensive. Alternative 4 is the less expensive of the two remedies that eliminate the principal threat at the site by removing the source.

STATE ACCEPTANCE

The state of Tennessee concurs with the selected remedy.

COMMUNITY ACCEPTANCE

Community acceptance addresses the issues and concerns the public may have regarding remedial alternatives. The "Highlights of Community Participation" section summarizes community participation for this project. The selected remedy was not modified based on public comments. The "Responsiveness Summary," Part 3 of this ROD, presents DOE responses to public comments on the proposed plan.

SELECTED REMEDY

DOE, with concurrence from EPA and TDEC, has determined that the preferred alternative presented in the March 1998 proposed plan (DOE 1998a) is the most appropriate remedy for protection of human health and the environment at the K-1070-A Burial Ground. The selected remedy, Waste Removal and Disposal and Institutional Controls (Alternative 4), consists primarily of excavating the waste from the trenches and pits and disposal in the ORR on-site disposal facility. Off-site disposal of a relatively small volume ofuraste may be required.

The selection of this remedy is based on the comparative analysis of alternatives summarized in this ROD. This alternative provides the best balance of trade-offs with respect to CERCLA criteria used to evaluate remedial alternatives. The alternative is effective in both the short term and the long term. The selected remedy provides for the overall protection of human health and the environment, complies with ARARs, and is cost-effective. This remedy uses permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. The alternative does not directly meet the statutory preference for treatment as a principal element because no effective treatment technologies were identified in the FS; however, some waste may require treatment to meet LDRs or disposal facility WAC. The amount of waste requiring treatment and the types of treatment that are appropriate will be determined during implementation of the action.

The major components of the selected remedy are site preparation, excavation, segregation of unbreached containers for special processing, waste transport, disposal, and backfilling and grading. Following implementation of the remedial action, monitoring and current use restrictions will be maintained for groundwater and surface water as part of ETTP sitewide S&M activities until these media are addressed by subsequent CERCLA decisions. In the interim, DOE, EPA, and TDEC will evaluate the need for action should contaminant concentrations in surface water at Spring 21-002 exceed regulatory thresholds of the AWQC. Any proposed action would be presented to the public for review according to CERCLA and EPA.

Contaminated soil commingled with the waste as well as visually discolored and disturbed soil adjacent to and underlying the trenches and pits will be removed. No known unacceptable residual risk from soils for industrial or recreational land use will remain within the K-1070-A Burial Ground fenced area following completion of the remedial action defined in this ROD. However, final remedial decisions for soil outside and inside the excavated area within the K-1070-A Burial Ground fenced area will be addressed under subsequent CERCLA decisions to ensure consistency with final land use decisions.

This action does not address restoration or rehabilitation of any natural resource injuries that may have occurred at the site, nor whether such injuries have occurred. In the interim, neither DOE nor TDEC waives any rights or defenses they may have under CERCLA Sect. 107(a)(4)(c).

Components of the selected remedy are described here.

SITE PREPARATION

Site preparation includes providing temporary surface water drainage and erosion control measures, site utilities, and construction support areas. Support areas will include decontamination areas, administrative office trailers, personnel change facilities, and temporary storage areas.

CONSTRUCTION: EXCAVATION OF TRENCH AND PIT MATERIAL

Standard excavation equipment will be used to remove approximately 4 ft of existing soil cover, which will be stockpiled separately to be used as backfill. Waste removed from the trenches and pits will be placed in lined trucks or containers for transport to the ORR on-site disposal facility. During excavation, protective measures including continuous radiological and air monitoring will be used to ensure worker safety. Special precautions will be implemented as needed during excavation and handling to protect against dangers associated with the waste. All activities under the selected remedy will be conducted following the overriding principle of ALARA for radiological exposure. Appropriate measures will be used to control fugitive dust emissions. As the waste is excavated, unbreached containers and cylinders will be segregated for special handling. While it is not expected that classified waste is present in the trenches and pits, personnel trained in recognition and disposition of classified materials will monitor all waste excavated from the site to ensure that appropriate measures are implemented in the event that such materials are encountered. The presence of significant amounts of classified materials would impact the project schedule. The estimated waste volume requiring excavation is approximately 19,500 yd^3 of debris and associated soil.

SEGREGATION AND HANDLING OF CONTAINERIZED WASTE

Trench and pit excavation would proceed deliberately because of potential waste hazards and the need to avoid rupturing intact containers. Intact cylinders and containers will be segregated as they are excavated and then moved to temporary bermed and diked storage areas at the site for identification, special handling, and disposition. Appropriate precautions will be taken to protect workers against such hazards as splashing, vapor releases, reaction of the container contents with air or water, and explosions from shock-sensitive material.

BACKFILLING AND GRADING

The trenches and pits will be backfilled and graded after excavation using the stockpiled cover soil removed at the beginning of construction. A source of additional fill soil will be identified if needed at that time.

WASTE TRANSPORTATION AND DISPOSAL

Most or all excavated waste will be transported to the ORR on-site disposal facility in lined trucks or containers. This facility is considered to be protective and is approved for disposal of LLW and mixed waste. Any waste that cannot be treated to meet the WAC for the on-site disposal facility will be temporarily stored in a safe and compliant manner before being transported to an off-site disposal facility in intermodal containers via truck. Off-site disposal facilities, if needed, will be selected during implementation of the action and specified in post-ROD documentation.

MONITORING AND MAINTENANCE

Following implementation of the remedial action, protectiveness at the site will be ensured through continuation of current ETTP sitewide controls, including physical and administrative access restrictions, surveillance, security patrols, restrictions on excavation, and restrictions on groundwater and surface water use. Surface water and groundwater sampling and analysis will be conducted as part of ETTP sitewide S&M activities until these media are addressed by subsequent CERCLA decisions. Groundwater monitoring wells will be maintained as required. The monitoring plan will be defined in the appropriate CERCLA documentation (i.e., the remedial action report). Monitoring results will be included in the annual ORR *Remediation Effectiveness Report*. Any long-term restrictions or controls required for the site as part of final actions will be documented in accordance with the ORR LUCAP (DOE 1999).

STATUTORY DETERMINATIONS

Under CERCLA Section 121, selected remedies must protect human health and the environment, comply with ARARs (unless a statutory waiver is justified and granted), be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that significantly and permanently reduces the volume, toxicity, or mobility of hazardous wastes as their principal element.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment by removing waste from the site, thereby minimizing the potential for contaminant migration and future exposure. The excavated material will be effectively isolated in an approved disposal facility. Monitoring of groundwater and surface water impacted by past contaminant releases and use restrictions will be conducted as part of ETTP sitewide S&M activities pending final remedies for these media under future CERCLA decisions. Implementation of this remedial action will not pose unacceptable risks to site workers or members of the public.

COMPLIANCE WITH ARARs

The selected remedy will comply with all ARARs. A relatively small volume of waste may not be amenable to treatment to meet the WAC for the ORR on-site disposal facility and require off- site disposal. All ARARs associated with off-site disposal (e.g., packaging, manifesting, and transportation requirements) would be met. The ARARs for the selected remedy are provided in Table 2.5. ARARs for groundwater will be addressed as required in documentation for future CERCLA decisions.

Chemical-Specific ARARs. Chemical-specific ARARs set health- or risk-based concentration limits or discharge limits for various environmental media for specific hazardous substances, pollutants, or contaminants. These requirements generally set protective cleanup levels for the chemicals of concern in the designated media or indicate a safe level of discharge when considering a specific remedial activity.

The selected remedy is a source removal action focusing on the excavation of buried waste. No cleanup standards for environmental media were identified for this action. There will be incidental removal of contaminated soil associated with the waste, but soil is not being addressed as a primary medium of concern. Because final decisions for the remediation of groundwater are deferred, groundwater contamination will be addressed under future CERCLA decisions. The chemical-specific ARARs identified for this action are limited to radiological exposure limits during implementation of the action. Chemical-specific ARARs for exposure limits for radiological emissions will be met. Selected NRC regulations designated as R&A requirements define limits on radiological exposures from all pathways and all sources. The overriding principle of the requirements is that all releases of radioactive material shall be ALARA.

Location-Specific ARARs. Location-specific requirements restrict the concentration of hazardous substances or the conduct of activities solely because they are in special locations (53 FR 51437, 55 FR 8741). Based on current information for the K-1070-A Burial Ground, no location specific ARARs will be triggered.

Action-Specific ARARs. Action-specific ARARs are performance, design, or other requirements that set controls or restrictions on particular kinds of activities related to the

Table 2.5. ARARs for K-1070-A Burial Ground, East Tennessee Technology Park, Oak Ridge, Tennessee

Activity	Requirement	Prerequisite	Citation
	Chemical-specific		
Control of radiological emissions	Exposures to members of the public from all radiation sources into the atmosphere shall not cause an EDE to be > 10 mrem (0.1 mSv)/year	Emission of radionuclides into the air—**applicable**	40 CFR 61.92; Rules of the TDEC 1200-3-11-.08
	Exposure to the individual members of the public from radiation shall not exceed a total EDE of 0.1 rem/year (100 mrem/year), exclusive of the dose contributions from background radiation, any medical administration the individual has received, or voluntary participation in medical/research programs	Release of radionuclides into the environment from construction operations, grading of roads, or the clearing of land—**relevant and appropriate**	10 CFR 20.1301(a)
	Shall use, to the extent practicable, procedures and engineering controls based on sound radiation protection principles to achieve doses to members of the public that are ALARA		10 CFR 20.1101(b)
	Action-specific		
Control of surface water runoff	Implement good site planning and best management practices to control storm water discharges including: • document best management practices in a storm water control plan or equivalent report, • minimal clearing for grading, • removal of vegetation cover only wihin 20 days of construction, • perform weekly erosion control inspections and maintenance, • control measures to detain runoff, and • discharges must not cause erosion	Applicable to the control of storm water discharges associated with construction activities that result in a disturbance of >5 acres of total land area. For those sites with <5 acres affected— **relevant and appropriate**	Rules of the TDEC 1200-4-10-.05

Table 2.5 (continued)

Activity	Requirement	Prerequisite	Citation
Control of fugitive dust emissions	Take reasonable precautions to prevent particulate matter from becoming airborne; no visible emissions are permitted beyond property boundary lines for more than 5 minutes/hour or 20 minutes/day	Nonpoint source air emission from environmental restoration—**applicable**	Rules of the TDEC 1200-3-8-.01
Treatment of decontamination wastewater	On-site wastewater treatment units that are part of a wastewater treatment facility subject to regulation under Section 402 or Section 307(b) of CWA (i.e., are NPDES-permitted) are exempt from the requirements of RCRA Subtitle C standards	All tank systems, conveyance systems, and ancillary equipment used to store or transport RCRA contaminated wastewater—**applicable**	40 CFR 264.1(g)(6); 40 CFR 260.10; 40 CFR 270.1(c)(2) Rules of the TDEC 1200-1-11-.06(1)(b) Rules of the TDEC 1200-1-11-.01(2)(a) Rules of the TDEC 1200-1-11-.07(1)(b)
Characterization/management of primary and secondary wastes streams generated during remediation	A person who generates solid waste must determine whether that waste is hazardous using various methods, including application of knowledge of the hazardous characteristics of the waste based on information regarding the materials or processes used. If the waste is determined to be hazardous, the waste must be handled in accordance with 40 CFR 260-268	Wastes generated during activities potentially contaminated with RCRA-characteristic waste—**applicable**	40 CFR 262.11; Rules of the TDEC 1200-1-11-.03(1)(b)
Characterization of LLW (e.g., contaminated PPE, debris, soils, wastewater)	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the WAC of the receiving facility.	Generation of LLW for storage or disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(I)
	Characterization data shall, at a minimum, include the following information relevant to the management of the waste:		DOE M 435.1-1(IV)(I)(2)
	• physical and chemical characteristics;		DOE M 435.1-1 (IV)(I)(2)(a)
	• volume, including the waste and any stabilization or absorbent media;		DOE M 435.1-1 (IV)(I)(2)(b)

Table 2.5 (continued)

Activity	Requirement	Prerequisite	Citation
	• weight of the container and contents;		DOE M 435.1-1 (IV)(2)(c)
	• identities, activities, and concentrations of major radionuclides;		DOE M 435.1-1 (IV)(2)(d)
	• characterization date;		DOE M 435.1-1 (IV)(2)(e)
	• generating source; and		DOE M 435.1-1 (IV)(2)(f)
	• any other information which may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with performance objectives.		DOE M 435.1-1 (IV)(2)(g)
Temporary storage of LLW	Ensure that radioactive waste is stored in a manner that protects the public, workers, and the environment and that the integrity of waste storage is maintained for the expected time of storage.	Management of LLW at a DOE facility—**TBC**	DOE M 435.1-1 (IV)(N)(1)
	Shall not be readily capable of detonation, explosives decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water		DOE M 435.1-1 (IV)(N)(1)
	Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage.		DOE M 435.1-1 (IV)(N)(3)
	Shall be managed to identify and segregate LLW from mixed waste.		DOE M 435.1-1 (IV)(N)(6)
Packaging of LLW (e.g., debris, PPE, rags)	Shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container.	Storage of LLW in containers at a DOE facility—**TBC**	DOE M 435.1-1 (IV)(L)(1)(a)

Table 2.5 (continued)

Activity	Requirement	Prerequisite	Citation
	Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container.		DOE M 435.1-1 (IV)(L)(1)(b)
	Containers shall be marked such that their contents can be identified.		DOE M 435.1-1 (IV)(L)(1)(c)
Packaging of LLW for disposal (e.g., PPE, debris)	Must have structural stability either by processing the waste or placing the waste in a container or structure that provides stability after disposal.	Generation of LLW for disposal at a LLW disposal facility—**relevant and appropriate**	TDEC 1200-2-11-.17(7)(b)(1)
	Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.		TDEC 1200-2-11-.17(7)(b)(3)
Treatment of LLW	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility.	Generation of LLW for disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(O)
Disposal of LLW at an on-site disposal facility or an off-site disposal facility	LLW shall be certified as meeting waste acceptance requirements before it is transferred to the receiving facility.	Generation of LLW for disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(J)(2)
Characterization of debris potentially containing RCRA hazardous waste	Surface contamination or a representative sample of debris must be characterized to determined whether it is RCRA-characteristic waste and whether it is waste restricted from land disposal using the TCLP or operator knowledge	Debris contaminated with RCRA-hazardous waste—**applicable**	40 CFR 262.11; 40 CFR 268.7(a); Rules of the TDEC 1200-1-11-.03(1)(b); Rules of the TDEC 1200-1-11-.10(1)(g)

Table 2.5 (continued)

Activity	Requirement	Prerequisite	Citation
Temporary storage of hazardous waste in container (e.g., PPE, rags, etc.)	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171-173 (subpart I); and • container is marked with the words "hazardous waste" or;	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 200.10—**applicable**	40 CFR 262.34(a) TDEC 1200-1-11-.03(4)(e)
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal or less of RCRA hazardous waste at or near any point of generation—**applicable**	40 CFR 262.34(c)(1) TDEC 1200-1-11-.03(4)(e)(5)
Use and management of hazardous waste in containers	If container is not in good condition (e.g., severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition.	Storage of RCA hazardous waste in containers–**applicable**	40 CFR 264.171 TDEC 1200-1-11-.05(9)(b)
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired;		40 CFR 264.172 TDEC 1200-1-11-.05(9)(c)
	Keep containers closed during storage, except to add/remove waste;		40 CFR 264.173(a) TDEC 1200-1-11-.05(9)(d)(1)
	Open, handle and store containers in a manner that will not cause containers to rupture or leak.		40 CFR 264.173(b) TDEC 1200-1-11-.05(9)(d)(2)
Treatment of RCRA-hazardous waste	Must treat to meet LDRs for any identified RCRA-characteristic wastes	Wastes that are determined to be RCRA-hazardous wastes —**applicable**	40 CFR 268.40(a) Rules of the TDEC 1200-1-11-.10(3)(a)
Treatment of debris containing RCRA-hazardous waste	Hazardous debris must (1) be treated by specified technologies based on the type of debris and type of contaminants before land disposal or (2) be treated to meet existing treatment standards for the specific waste contaminating the debris	Debris contaminated with RCRA-characteristic waste—**applicable**	40 CFR 268.45; Rules of the TDEC 1200-1-11-.10(3)(f)(4)

Table 2.5 (continued)

Activity	Requirement	Prerequisite	Citation
Management and disposal of PCB waste (e.g., contaminated PPE, equipment, soils, wastewater)	Any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761, Subpart D	Generation of waste containing PCBs at concentrations $ 50 ppm—**applicable**	40 CFR 761.50(a)
	Any person cleaning up and disposing of PCBs shall do so based on the concentrations at which the PCBs are found	Generation of PCB remediation waste as defined in 40 CFR 761.3—**applicable**	40 CFR 764.61
Transportation of wastes and decontaminated water to other ORR locations	Must meet the substantive requirements, including placarding and pretransport requirements, of the DOT hazardous materials regulations	If uncontrolled public roads are used for transportation of waste—**applicable**	49 CFR 171, 172, 173, and 177
	The generator manifesting requirements of 40 CFR 262.20 through 262.32(b) do not apply.	Transportation of hazardous waste on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way—**applicable**	40 CFR 262.20(f) TDEC 122-1-11-.03(3)(a)(6)
	Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.81 in the event of a discharge of hazardous waste on private or public right-of-way.		
Transportation to off site disposal facility	The waste must meet all DOT requirements including packaging, labeling, marking, placarding, and pretransport requirements	Transportation of hazardous and radioactive materials above exempt quantities—**applicable**	49 CFR 171, 172, 173, and 177; DOE Order 460.1, and 460.2 (TBC)
	Must meet packaging requirements based on the maximum activity of radioactive material in a package	Packaging of radioactive materials above exempt quantities for public transport—**applicable**	49 CFR 173.411; 49 CFR 173.431; 49 CFR 173.433; 49 CFR 173.435
	Must be marked with hazardous waste marking, generator's name and address, and the manifest docket number	Transportation of hazardous waste in containers of 110 gal or less—**applicable**	40 CFR 262.32(b) Rules of the TDEC 1200-1-11-.03(4)(c)

Table 2.5 (continued)

Activity	Requirement	Prerequisite	Citation
	LLW waste shall be packaged and transported in accordance with DOE O 460.1A and DOE O 460.2.	Shipment of LLW of site **– TBC**	DOE M 435.1-1(I)(1)(E)(11)
	To the extent practicable, the volume of waste and number of shipments shall be minimized.		DOE M 435.1-1(IV)(L)(2)
	Must comply with the manifesting provisions at 40 CFR 761.207 through 218.	Reliquishment of control over PCB wastes by transporting, or offering for transport – **applicable**	40 CFR 761.207 (a)
Off-site disposal of wastes	Wastes shipped off site for disposal must be to a facility approved by EPA to accept CERCLA wastes	Off-site shipment of wastes from CERCLA response actions **– applicable**	40 CFR 300.440

ALARA = as low as reasonably achievable
ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR = *Code of Federal Regulations*
CNF = Central Neutralization Facility
CWA = Clean Water Act of 1972
DOE = U.S. Department of Energy
DOT = U.S. Department of Transportation
EDE = effective dose equivalent
EPA = U.S. Environmental Protection Agency
> = greater than
gal = gallon
LDR = land disposal restriction
< = less than
LLW = low-level (radioactive) waste
mrem = millirem
mSv = millisievert
NPDES = National Pollutant Discharge Elimination System
ORO = Oak Ridge Opertions
ORR = Oak Ridge Reservation
% = percent
PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act of 1976
PPE = personal protective equipment
TBC = to be considered
TCLP = Toxicity Characteristic Leaching Procedure
TDEC = Tennessee Department of Environment and Conservation
WAC = waste acceptance criteria

management of hazardous substances under the selected remedy (55 FR 8741, March 8, 1990). Selection of a particular action at a site triggers action-specific ARARs that may specify performance standards or technologies.

The K-1070-A Burial Ground received both LLW and waste containing RCRA hazardous constituents. Therefore, for purposes of ARAR identification, the waste is assumed to be LLW, hazardous waste as defined by RCRA, and mixed waste. Toxic Substances Control Act of 1976 polychlorinated biphenyl waste may also be present.

Any empty containers contaminated with RCRA-hazardous waste that are removed from the landfill will be exempt from RCRA (including the LDRs) if they meet the definition of a container as specified in 40 CFR 260.10 [Rules of the TDEC 1200-1-11-.01(2)(a)] and meet the requirements specified in 40 CFR 261.7(b)(1) (Rules of the TDEC 1200-1-11-.02(l)(a)] for empty containers. Any container contaminated with RCRA-hazardous waste that cannot qualify as an empty intact container must be handled and managed as hazardous debris.

Waste may be temporarily stored pending transfer to the ORR on-site disposal facility or to an off-site facility. Any waste requiring treatment to meet LDRs, or disposal facility WAC will be treated either at the site or at an on-ORR permitted facility. When on-site treatment is not feasible, wastes will be sent to an off-site facility for treatment and disposal. Any facility used for the storage of hazardous waste pending treatment must comply with the applicable requirements of 40 CFR 264 and Rules of the TDEC 1200-1-11.06.

Primary and secondary wastes generated during remedial activities may be contaminated with RCRA-hazardous waste, LLW or mixed waste. After excavation, wastes must be properly characterized, segregated, and treated as necessary to meet LDRs. Generators of LLW are required to characterize and segregate the waste and to minimize the amount generated in compliance with DOE Order 435.1, "Radioactive Waste Management," and the implementing Manual 435.1-1.

If uncontrolled public roads are used for transportation of waste on ORR, the substantive provisions of the U.S. Department of Transportation Hazardous Material Regulations will be applicable. If wastes generated from a CERCLA response action are transferred off site, all administrative as well as substantive provisions of all applicable requirements must be met, including those for transportation. Waste generators must ensure and document that the hazardous waste they generate is properly identified and transported to a treatment, storage, and disposal facility.

CERCLA Section 121(d)(3) provides that the off-site transfer of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions be to a facility that is in compliance with applicable federal and state laws and has been approved by EPA for CERCLA waste acceptance.

COST-EFFECTIVENESS

Actions taken under CERCLA must consider the estimated total present worth cost of alternatives. The selected remedy provides overall protectiveness proportional to its cost. This action is the less expensive of the two remedies that eliminate the principal threat at the site by removing the source.

Table 2.6 provides a cost summary for the selected remedy. Costs for waste disposal include transportation cost. The estimated cost for the selected remedy for on-site disposal assumes that 5 percent of the waste could not be treated to meet the WAC for the ORR on-site disposal facility and would require off-site disposal. For the evaluations supporting this ROD, Envirocare of Utah, Inc. (Envirocare), was used as the representative disposal facility for all off-site shipments; however, any suitable off-site facility may be used for this action.

Sampling and analysis for continued surface water and groundwater monitoring account for the majority of the O&M cost as presented in Table 2.6. While these elements will be conducted as part of ETTP sitewide S&M activities, their costs are included here for the purpose of comparison.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies or resource recovery technologies may be used cost-effectively. Excavation of buried waste and permanent disposal in an approved disposal facility removes the source of contamination, thereby eliminating the threat of future contaminant releases or direct contact with waste. Of the remediation alternatives considered, the selected remedy provides the best balance of trade-offs with respect to long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. Over the long-term, this solution is expected to perform effectively and continue to be protective with minimal maintenance.

Table 2.6. Cost summary for the selected remedy, K-1070-A Burial Ground, East Tennessee Technology Park, Oak Ridge, Tennessee[a]

Activity	With on-site disposal ($ millions)	With off-site disposal ($ millions)[b]
Site preparation, waste removal, and site restoration	4.5	4.5
Cylinders and container removal	8.9	8.9
Waste sampling and analysis	*c*	8.1
Waste disposal—on site	5.0	0.0
Waste disposal—off site	1.2	14.5
Project integration	1.9	1.9
Capital cost—subtotal	**21.5**	**37.9**
O&M—30 years	2.9	2.9
Total project cost—escalated	**24.4**	**40.8**
Capital cost—present worth	18.7	33.0
O&M cost—present worth	0.9	0.9
Total project costs—present worth	**19.6**	**33.9**

[a]Present worth costs were calculated over a 30-year period. Capital costs were expended over the first 16 months of this period; O&M covered the entire period. A discount rate of 7% was used. The escalation factor used for 1999 and beyond was 2.7%.
[b]Off-site disposal costs are provided for comparison.
[c]Waste sampling and analysis cost for on-site disposal is included under waste removal and site restoration.

S = dollar
% = percent
O&M = operation and maintenance

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

This remedy does not directly meet the CERCLA Section 121 statutory preference for treatment to reduce toxicity, mobility, or volume as a principal element because no effective treatment technologies were identified in the FS. However, some waste may require treatment to meet LDRs or disposal facility WAC. Treatment of this waste would result in permanent reduction of toxicity or mobility.

DOCUMENTATION OF SIGNIFICANT CHANGES

DEFERRAL OF GROUNDWATER REMEDIAL DECISIONS

The original scope for K-1070-A included groundwater beneath and downgradient of the burial ground. DOE, EPA, and TDEC agreed subsequent to release of the proposed plan that deferring final groundwater decisions for K-1070-A to future CERCLA decisions is a preferable strategy. This strategy will provide the opportunity to evaluate additional groundwater data collected from site monitoring wells and ensure that the final decision addressing groundwater at K-1070-A is consistent with groundwater remedial decisions throughout ETTP.

The proposed plan presented a contingency action for surface water at Spring 21-002, consisting of installing an 25-ft-deep, 50-ft-long trench with a reactive gate. This contingency action, consisting primarily of a groundwater treatment component, was to be implemented if contaminant concentrations in surface water at Spring 21-002 exceeded AWQC. Consistent with deferral of groundwater remedies to future CERCLA decisions, this contingency action would not be implemented. Instead, DOE, EPA, and TDEC will evaluate the need for action should contaminant concentrations exceed regulatory thresholds of the AWQC. Any proposed remedy would be presented to the public for review per CERCLA and the FFA.

PUBLIC COMMENTS

DOE, EPA, and TDEC have reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, the three parties determined that no significant changes to the selected remedy, as originally identified in the proposed plan, were necessary.

PROJECT SCHEDULE

Table 2.7 provides key schedule elements and proposed dates for the K-1070-A Burial Ground project. Commencement of construction activities is based on the availability of on-site disposal capacity for waste excavated from the trenches and pits. The construction start in August 2001 assumes that the ORR on-site disposal facility will be available to receive waste excavated from the K-1070-A Burial Ground by October 2001.

Table 2.7. Project schedule for the K-1070-A Burial Ground, East Tennessee Technology Park, Oak Ridge, Tennessee

Activity	Date
EPA/TDEC approval of the ROD	January 2000
EPA/TDEC approval of the RDWP	May 2000
Contract award	September 2000
Issue RDR/RAWP to EPA/TDEC for approval	July 2001
Construction start	August 2001
Construction Completion	July 2002

EPA = U.S. Environmental Protection Agency
RAWP = remedial action work plan
RDR = remedial design report
RDWP = remedial design work plan
ROD = record of decision
TDEC = Tennessee Department of Environment and Conservation

REFERENCES

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PART 3. RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

This responsiveness summary serves three major purposes. First, it informs DOE, EPA, and TDEC of community concerns and preferences regarding the site and the selected remedy. Second, it demonstrates how public comments were integrated into the decision-making process. Third, it allows DOE to record formal responses to public comments.

This responsiveness summary documents all public comments on the proposed plan (DOE 1998a) issued in March 1998. The public comment period was from March 16 to April 14, 1998. DOE announced the availability of the proposed plan in *The Knoxville News-Sentinel, The Roane County News*, *The Oak Ridger*, and other local papers within the region of influence at the beginning of the comment period. A public meeting was held in Oak Ridge on April 7, 1998. The transcript of the public meeting (DOE 1998c) is available at the Information Resource Center, 105 Broadway Avenue. Oak Ridge, Tennessee.

This responsiveness summary was prepared in accordance with the terms of the 1992 FFA among DOE, EPA, and TDEC, as well as other requirements including:

- CERCLA as amended by SARA (42 USC Sect. 9601, et seq.);
- NCP (40 CFR 300.430); and
- *Community Relations in Superfund, A Handbook* (EPA OSWER Directive 9230.0-3B).

COMMUNITY PREFERENCES

The public comments on the proposed plan are presented in this responsiveness summary along with the DOE responses. Two commentors, Mr. Bruce D. Lawson and the Citizens Advisory Panel of the ORR Local Oversight Committee, supported selection of Alternative 4, the preferred alternative presented in the proposed plan. One commentor at the public meeting expressed concern regarding the cost of the selected remedy when compared with the estimated risk reduction and size of the area being remediated.

INTEGRATION OF COMMENTS

Public comments did not change the selection of the preferred alternative.

COMMENTS AND RESPONSES

WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

CITIZEN'S ADVISORY PANEL OF THE OAK RIDGE RESERVATION LOCAL OVERSIGHT COMMITTEE, SUSAN L. GAWARECKI, EXECUTIVE DIRECTOR; LETTER TO MARGARET WILSON, APRIL 15, 1998

Comment: **The Citizen's Advisory Panel (CAP) of the Oak Ridge Reservation Local Oversight Committee (LOC), submits the following comments on the *Proposed Plan for the East Tennessee Technology Park (ETTP) K-1070-A Burial Ground, Oak Ridge, Tennessee* (DOE/OR/02-1615&D3) dated in March 1998. The LOC Board has not had the opportunity to review and approve the comments, and thus these comments should be considered submitted by the CAP only.**

The LOC is a non-profit regional organization funded by the State of Tennessee and established to provide local government and citizen input into the environmental management and operation of the DOE ORR. The Board of Directors of the LOC is composed of the County Executives of Anderson, Knox, Loudon, Meigs, Morgan, Rhea, and Roane Counties; the Mayor of the City of Oak Ridge; and the Chairs of the Roane County Environmental Review Board (RCERB), the City of Oak Ridge Environmental Quality Review Board (EQAB), and the LOC CAP. The CAP currently has 19 members with diverse backgrounds who represent the greater ORR region.

The CAP concurs with the selection of Alternative 4: Waste Removal and Disposal and Institutional Controls. As pointed out by John Sweeney at the Public Meeting on April 7, 1998, removing the source prevents further introduction of contaminants into the soil and groundwater.

Concentrations of contaminants released to the environment from the K-1070-A Burial Ground are likely self limiting because of the highly fluctuating water table and karst geology. This situation allows rapid drainage and resulting significant dilution of the contaminants from the pits and trenches. For this reason, the CAP does not see the need for groundwater treatment, as proposed in Alternative 5.

The primary justification for remediation of this site, reduction of risks posed by future releases from containers in the burial ground, way not be entirely correct due to the groundwater situation described above. A more legitimate reason for remediation is to clean up the site in order to allow for a more orderly transition into private sector reindustrialization

of ETTP. In this case, the CAP feels that promotion of reindustrialization is sufficiently meritorious rationale for waste removal from the K-1070-A Burial Grounds.

The validity of the cost estimate for the preferred alternative depends on the availability of an on-site disposal facility. The timely inception of the on-site disposal cell is necessary to make this remediation (and others) financially responsible. The CAP is concerned that delays in constructing an on-site disposal facility will result in higher project costs for waste storage containers, suitable storage space, long-distance transportation, and commercial disposal fees, as well as increased risks due to additional handling of the wastes. The CAP is concerned that should the project be delayed due to lack of a suitable disposal facility (either on- or off-site) that budget moneys will continue to decline and reindustrialization of ETTP will be further delayed.

The LOC CAP appreciates the opportunity to comment on the Proposed Plan for the K-1070-A Burial Ground.

Response (regarding a justification for the action): While potential transition to the private sector in support of ETTP's reindustrialization effort is clearly a benefit of remediating the K-1070-A Burial Ground, the primary reason for choosing the selected remedy is to ensure long-term protection of human health and the environment. Evidence suggests some potential for karst subsidence that could release greater amounts of contaminants. Deterioration of currently intact containers could also result in increased contaminant releases to the environment. Also, modeling conducted in support of the RI predicts that contaminant concentrations in surface water at Spring 21-002 will increase and may pose unacceptable future risk to human health and the environment. The cost of remediating contamination from such releases could substantially increase overall cleanup costs.

SUE RICE, ENVIROCARE OF UTAH, INC.

Comment: **I have the following comments regarding the above-mentioned Proposed Plan.**

1. **There was no mention of offsite disposal under Alternatives 4 and 5 that deal with disposal. Why, when the on-ORR disposal facility idea has not even completed the CERCLA process, was no offsite disposal alternative mentioned? Does DOE have a contingency plan for the K-1070-A Burial Ground project?**

Response: Off-site disposal is addressed as a contingency disposal option in the proposed plan. The following statement may be found on page 6 near the top of the left column: "If ORR has no disposal facility capable of accepting LLW, RCRA waste, or mixed waste, all waste would be sent off site." [*Proposed Plan for the East Tennessee Technology-Park K-1070-A Burial Ground, Oak Ridge Tennessee* (DOE 1998a)].

2. **I think it would be in the DOE's best interest to compare the costs of the proposed onsite disposal facility with an actual operating offsite disposal facility.**

Response: Detailed estimated costs for the selected remedy assuming off-site disposal are presented in the "Statutory Determinations" section of the "Decision Summary," Part 2 of this ROD. This cost estimate used the current pricing structure for DOE contracts with Envirocare, as modified to reflect an assumed large-volume discount. Envirocare is the representative off-site disposal facility used for evaluations to support this ROD. The estimated total project present worth cost for off-site disposal is $33.9 million, including waste transportation and characterization of waste to segregate LLW from mixed-waste.

3. **What potential RCRA treatment will be required for this waste material? Have the costs for RCRA treatment been included in DOE's cost of this alternative? If treatment is required, where and how will DOE treat the waste to meet RCRA land disposal restrictions?**

Response: While the selected remedy does not directly meet the statutory preference for treatment as a principal element, some waste streams may require treatment. However, the need for such treatment is uncertain, and the waste forms and types potentially requiring treatment cannot be sufficiently anticipated at this time. The amount of waste requiring treatment and the types of treatment that are appropriate will be determined during implementation of the selected remedy. A statement to this effect is included in the "Selected Remedy" section of the "Decision Summary," Part 2 of this ROD. Treatment might be conducted at the site, at an ORR treatment facility, or at the receiving off-site disposal facility, depending on the type(s) of treatment required and the ultimate disposition of the waste. The cost for treating the contents of intact containers, some of which may contain RCRA waste, is included in the cost estimate.

4. **If this project is scheduled in the near term, it would be in DOE's best interest to take a close look at using existing disposal facilities rather than wait for a proposed facility to be constructed which would prolong the risk to the public health and safety.**

Response: The ORR on-site disposal facility will be available to receive waste generated from implementation of the selected remedy. Because the greatest risks posed by the K-1070-A Burial Ground are projected to occur in the future, any increase in risk to public health and safety resulting from a temporary delay in implementing the selected remedy over the near-term would be minimal.

MR. BRUCE D. LAWSON

***Comment*: As a nearby resident (approx. 2½ mi. NE of K-1070-A Burial Ground) I would like to add my support for "Alternative 4 and 5." "Alternative 5" would be best due to the presence of dense non-aqueous phase liquid contaminants. The protection of human health should outweigh the cost considerations on this proposed project. The $25.9 million estimate seems rather small in comparison to future costs of litigation and medical care plus much more extensive remediation if the materials are not removed.**

Response: The protection of human health and the environment is foremost in the DOE selection of remedial action for the K- 1070-A Burial Ground. Excavation of waste and disposal in the ORR on-site engineered disposal facility would address the principal threats from the site by removing the source of contamination, thereby eliminating the potential for direct contact with waste or future migration of contaminants from the waste to the environment. Alternative 5 was not selected because of the uncertain effectiveness associated with remediating groundwater in bedrock at the site. Groundwater and surface water monitoring and use restrictions will continue at the site until final remedial decisions for these media are addressed under future CERCLA decisions. This approach will provide the opportunity to evaluate additional groundwater data collected at site monitoring wells and will help ensure that the final decision addressing groundwater and surface water downgradient of K-1070-A is consistent with remedial decisions throughout ETTP.

ORAL COMMENTS RECEIVED AT THE APRIL 7, 1998, PUBLIC MEETING

Comments from the April 7, 1998, public meeting were compiled from the official meeting transcript (DOE 1998c). Most were edited to ensure that they would be understandable as "stand alone" questions or statements outside the immediate context of meeting discussions. Where taken directly from the transcript, comments are enclosed in quotes. Commentors' names were not documented in the transcript and, therefore, are not provided in this Responsiveness Summary. The comments are noted by the page number on which they appear in the transcript. Questions from the meeting that provided only clarification on a point of discussion and did not address an issue or concern are not documented in this section.

***Comment 1*: How do you define on-site disposal? (*Transcript page 28.*)**

Response: On-site disposal refers to disposal within the boundaries of ORR. In contrast, off-site disposal includes any suitable location off ORR.

Comment 2*: Recent newspaper reports indicate significant future shortfalls in funding for ORR environmental restoration in FY 2000. Will these shortfalls impact the remediation of the burial ground? *(Transcript page 32.)

Response: Budget shortfalls always have an impact on the overall cleanup of ORR and often result in reprioritization of remedial activities. Should budgets be reduced as much as indicated in the referenced newspaper articles (a shortfall of $98 million), this project would be delayed. On the other hand, this project would remain a priority cleanup activity.

Comment 3*: If the cleanup of the burial ground is delayed, does DOE foresee funding for this cleanup becoming available later in 2002, 2006, or whenever? When will the burial ground be cleaned up? *(Transcript page 33.)

Response: DOE will continue to press for sufficient funding to clean up the burial ground on schedule. It is not possible at this time to predict the specific impacts of any potential budget shortfall or what the funding level might be for future fiscal years beyond 2000.

Comment 4*: "... we talk about making this land available for industrial use ... at what cost per acre?" *(Transcript page 34.)

Response: The actual cleanup cost per acre at the burial ground is high; however, the amount of land potentially made available for future industrial or recreational use could be significant because the burial ground occupies a pivotal position on the flank of Blackoak Ridge. However the issue of future land use is not the primary driver for cleanup. Risk reduction to ensure protection of human health and the environment, especially reduction of the potential for future significant releases, is the primary consideration in choosing the selected remedy.

Comment 5*: Risks elsewhere on the Reservation are higher than at this particular burial ground. Why does DOE see the need to spend $20 million here now when greater overall risk reduction might be achieved through cleanup elsewhere? *(Transcript page 34.)

Response: Because there is an unknown potential future risk from the release of contaminants from the site, the evaluation of risk reduction resulting from implementation of the selected remedy cannot be based solely on current risk levels. Modeling indicates that contaminant concentrations will increase in the future. Excavation of the waste will eliminate the potential for future unacceptable risks resulting from contaminant releases as the containers holding the waste deteriorate. The cost of remediating such future releases could be much greater than the cost of implementing the selected remedy.

In addition to risk reduction, implementation of the selected remedy will result in a reduction in the current level of land-use restrictions at the site, thereby supporting reindustrialization efforts at ETTP. The movement toward footprint reduction of ORR is currently focused on ETTP, where the K-1070-A Burial Ground is one of the key risk drivers.

Comment 6: **The proposed action involves disposal. Will this disposal not have impacts at the disposal site? "We save three acres here, how many acres do we make unavailable for industrial expansion at its" destination? *(Transcript pages 34-35)***

Response: The evaluation conducted for the disposal of CFRCLA waste expected to be generated from the sitewide cleanup of ORR incorporated waste volume estimates for various sites, including the K-1070-A Burial Ground. The relatively small volume of waste from K-1070-A will have little or no incremental impact on the areal extent of the disposal cell or the overall facility site.

Comment 7: **The recommended action of cleaning up the K-1070-A Burial Ground through excavation does not address the issue of other sites on the Oak Ridge Reservation currently releasing contaminants to the Clinch River. How do these sites compare in risk to the burial ground? *(Transcript page 37)***

Response: The K-1070-A Burial Ground ranked 21st in the overall ORR risk-based priority list as of December 1997; this priority list is updated annually and is available at the Information Resource Center. However, there are unknown potential future risks from the release of contaminants from K-1070-A that cannot be definitively estimated. Modeling indicates that contaminant concentrations will increase in the future to unacceptable levels. While the ORR sitewide ranking system is a useful tool to support remedial decision-making, site-specific conditions must be evaluated carefully in determining whether a site is to be remediated and what action should be taken.

Comment 8: **The projected cost for this action is about $20 million with the waste going to the proposed on-site disposal facility. How much additional cost would result if all waste went to Envirocare? *(Transcript pages 37-38)***

Response: The total project cost would increase by an estimated $16.6 million for off-site disposal rising from $24.4 million to $40.8 million. The total project present worth cost would increase by an estimated $14.3 million, rising from $19.6 million to $33.9 million. (Present worth cost is the amount of money required for investment, in current year dollars, to fund an alternative through completion.)

***Comment 9*: Are the costs for characterizing waste to determine whether it meets the waste acceptance criteria for disposal included in your cost estimates? (*Transcript page 38*)**

Response: Yes. Characterization costs are included for both the on- and off-site disposal estimates. Characterization costs are higher for off-site disposal because LLW and mixed waste must be identified for segregation before disposal.

***Comment 10*: Will the proposed on-site disposal facility be ready to accept waste from the K-1070-A Burial Ground in March 2000 as planned? (*Transcript page 39*)**

Response: Commencement of construction activities is based on the availability of on-site disposal capacity for waste excavated from the trenches and pits. The construction start date of August 2001 presented in this ROD assumes that the ORR on-site disposal facility will be available to receive waste excavated from the K-1070-A Burial Ground by October 2001.

***Comment 11*: Current levels of contaminants in the trenches are high. If the containers are intact, why are these levels high? (*Transcript page 40*)**

Response: Not all containers are expected to be intact, and some materials were disposed of in cardboard or other permeable containers.

***Comment 12*: Contaminant concentrations in the trenches are high, yet concentrations in groundwater are low by comparison. Doesn't this indicate that the trenches themselves are acting to contain the contaminants? (*Transcript page 40*)**

***Response*:** Infiltration studies and drive point sampling in the trenches demonstrate that they briefly retain water after storm events and that the trenches and surrounding clay act to laterally contain much of the contamination from breached containers and uncontainerized waste. However, chert layers within the clay carry water and contaminants downward to the bedrock aquifer fairly rapidly.

***Comment 13*: Rapid transport of dye during the tracer tests showed that groundwater moves quickly and in large volumes through the bedrock beneath the burial ground. Does dilution not account for the low concentrations of contaminants in groundwater? (*Transcript pages 40S42*)**

Response: Dilution accounts for much of the reduction in contaminant concentrations detected in groundwater compared with concentrations in some of the trenches and pits.

***Comment 14*: How do the contaminant levels compare to regulatory limits? (*Transcript page 43*)**

Response: Average concentrations of trichloroethene and other VOCs exceed MCLs for groundwater beneath and downgradient of the burial ground. Maximum gross alpha and beta radiation levels exceed MCLs. While contaminants from the burial ground have been detected at downgradient Spring 21-002, concentrations in surface water do not exceed AWQC.

***Comment 15*: My interpretation is that contaminant concentrations are relatively low beneath the burial ground and in surface water because of dilution. For problems to occur, with surface water quality in the future, dilution would have to be reduced. Collapse or subsidence at the burial ground or other larger releases would not cause the major problem. (*Transcript page 44*)**

Response: Collapse or subsidence could introduce large conta minant releases to groundwater and subsequently to surface water; it is not safe to assume that such releases would not pose an unacceptable risk to human health and the environment. Modeling predicts an increase in contaminant levels in surface water, even without sudden releases.

***Comment 16*: What was the nature of the model used and did it assume that contaminants were absorbed onto the soil? (*Transcript page 44*)**

Response: SESOIL was used to model movement of contaminants vertically from the burial ground through soil to bedrock. SESOIL is a standard model widely used to predict percolation through soil. Because groundwater models are typically not accurate or reliable in karst hydrogeologic systems, a method using dilution and attenuation factors based on chemical analyses was used to calculate horizontal contaminant transport in bedrock. Projections of contaminant transport in both soil and bedrock accounted for dilution and attenuation, including retardation of the soil.

***Comment 17*: Were samples taken from cavities in bedrock below or immediately downgradient of the burial ground? Are contaminant levels there significantly higher than at the spring? (*Transcript pages 44S45*)**

Response: Yes. Contaminant levels in these cavities are orders of magnitude greater than those observed at Spring 21-002, going roughly from parts per million in the cavities to parts per billion in the spring.

***Comment 18*: Will any delay in the cleanup of the burial ground impact reindustrialization efforts?**

Response: Perhaps to some extent, but overall redevelopment of ETTP will proceed regardless.

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